

Modeling & Simulation for Enterprise Test and Evaluation



Shala Malone

Combat Systems Performance Manager
PEO IWS 7D
202-781-2133
Shala.Malone@navy.mil

13 March 2008

Distribution Statement A: approved for public release.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 13 MAR 2008		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Modeling & Simulation for Enterprise Test and Evaluation				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Program Executive Office for Integrated Warfare Systems, US Naval Sea Systems Command				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES 2008 DoD M&S (Modeling and Simulation) Conference, presentations held in Orlando, Florida on March 10 - 14, 2008, The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 14	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Operational Context: Ship Self Defense



**Radars: SPS-49, SPS-48,
SPQ-9B, MFR...**



CIWS/SEARAM sensor



ES, IRST



SLQ-32, advanced ES

DEW



CEC, OATM

SSDS

**Open
Architecture**



TSCE



CIWS gun



Signature control

*Ship Defense MOE
Probability of Raid Annihilation (P_{RA})*

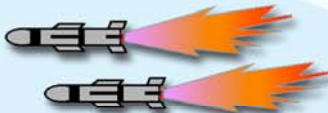
*is the ability of a particular stand-alone ship **as a system** to detect, control, engage, and defeat a specified raid of threats within a specified level of probability in an operational environment*



**NATO Seasparrow,
ESSM**

Onboard EA

**MK 214
Chaff**



Multi-threat raid

- Subsonic, supersonic, high diver
- Hi-G maneuvers
- Multi-mode seekers



NULKA



RAM

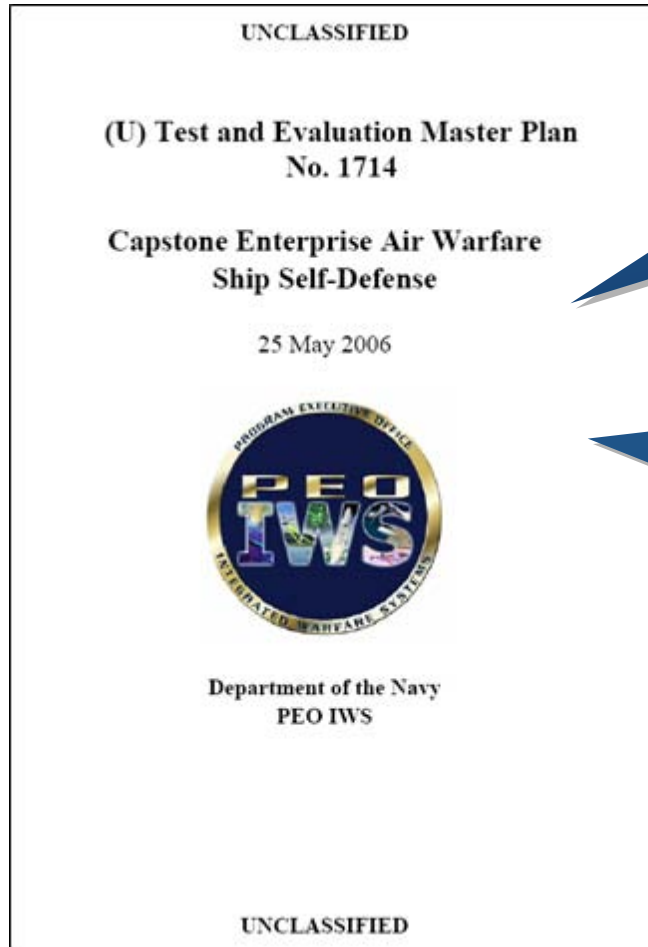
**MK 216
Chaff**

*Battle
Timeline \approx 30 seconds*

*Battle
Space \approx 0-12 nmi*



Enterprise Test & Evaluation Master Plan



The purpose of the Capstone Enterprise Air Warfare Ship Self Defense (AW SSD) Enterprise Test and Evaluation Master Plan (TEMP) is to consolidate all AW SSD at-sea testing and P_{RA} Testbed testing

The AW SSD T&E Enterprise Strategy is founded on a two-tiered process to assess AW SSD warfare systems performance:

- 1) Validate models with live testing
 - Operational Ship testing
 - Self Defense Test Ship (SDTS) testing
- 2) Assess performance with models

Test Events DT/OT-ET15 thru ET19 are formal P_{RA} Testbed events

Includes DDG 1000, LHA 6, LCS and CVN 21 ship classes



Enterprise P_{RA} Testbed System Engineering – Drivers for Centralized IWS Leadership

- **Systems performance for P_{RA} assessment spans different technical communities and multiple managing program offices**
- **P_{RA} will be assessed using a federation of interoperable simulations; it will not (cannot) be tested empirically**
 - Complex, multi-spectral, integrated HK/EW problem space
- **Many specific parameters, assumptions, and limitations are negotiated between the testing and acquisition communities**
- **The testing community is intent on consistent P_{RA} assessment across ship classes and warfare system configurations**
 - Different hulls, different configurations...same threat models, same virtual range conditions



Enterprise Test Planning & Execution

- **Non-traditional factors**

- M&S events as formal test events
 - “Virtual Range” requirement
- Expectation for formal, planned data flow from empirical testing to model validation

- **Organization and planning are combat-system-centric vice platform-centric**

- Single Enterprise Test Team
- Centralized management and resourcing of P_{RA} Testbed
- Multiple ship classes provide testing data supporting P_{RA} Testbed component development and validation



Navy Ship Self Defense T&E Enterprise IPT Structure

SSD T&E Enterprise IPT

Chair: PEO IWS

Representatives:

- DOT&E
- COTF
- OSD (AT&L)
- SEA 06
- IWS WSEs
- Ship Class Reps
- IWS MPM Reps
- N7
- N43
- N091

Chair
NAVSEA PH

*SDTS Configuration
Working Group*

Chair IWS 1TE

*Test Planning &
Execution
Working Group*

*Threat
Representation
Working Group*

Chair N091

Sub-group chairs: N43 for targets, IWS 7D for models

Chair
IWS 7D

*P_{RA} Testbed
Configuration
Working Group*

Co-chairs:
IWS 7D
Ship Class rep

*Testbed Ship
Class Baseline*

*Testbed Ship
Class Baseline*

*Testbed Ship
Class Baseline*

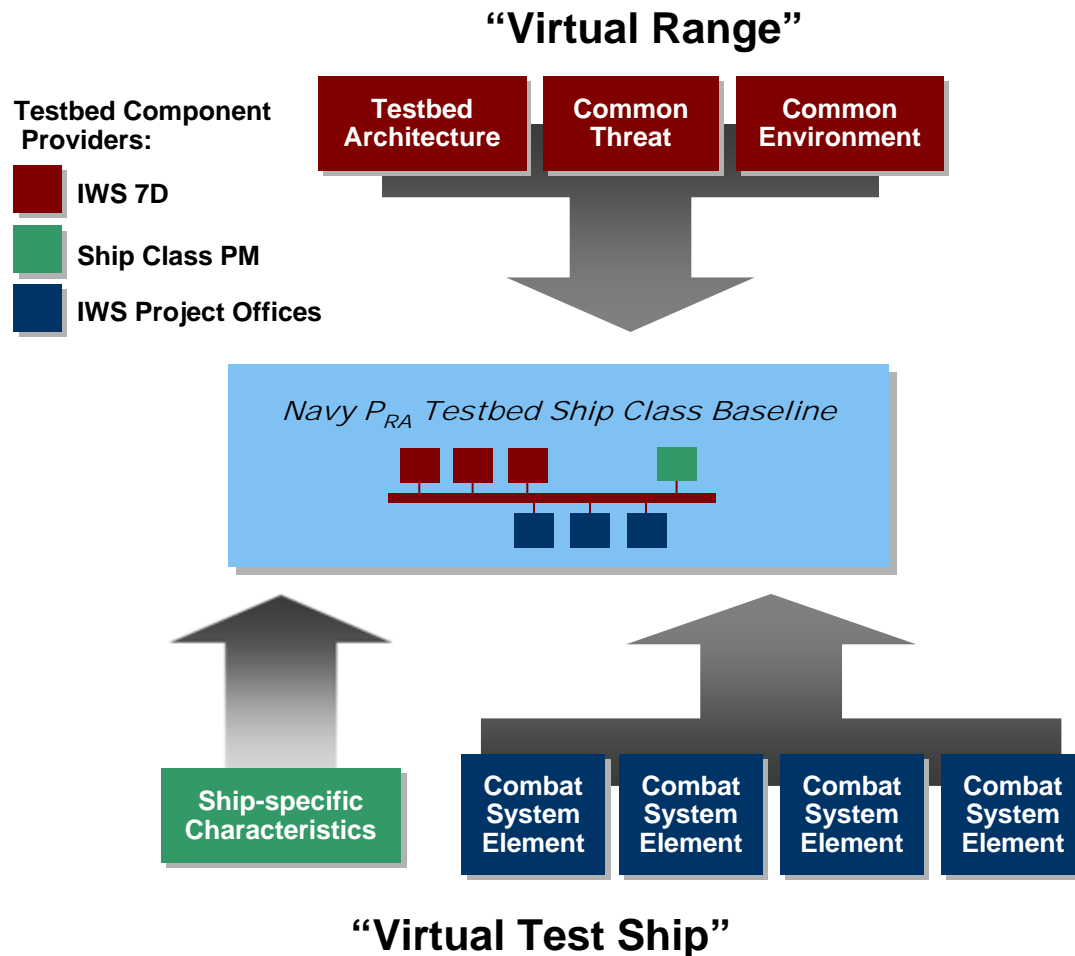


Enterprise P_{RA} Testbed System Engineering

- **Engineering one Enterprise Testbed, which is instantiated in several unique configuration baselines**
 - Formally accredited Baselines are correlated to Enterprise test events and ship class OPEVALs
 - Element Project Offices are vendors to Enterprise not individual ship classes
- **One master set of requirements for the Testbed**
 - Fed by both Enterprise SE and Baseline IPTs
 - Allocated and adjudicated according to Enterprise deliveries
- **A single Enterprise delivery may provide capability to more than one Testbed Baseline**
 - A single set of SE artifacts is maintained at the Enterprise level
- **Testbed-based Enterprise test events will be treated as empirical events**
 - E.g., test readiness reviews, test objectives



Enterprise P_{RA} Testbed Components



“Virtual Range” (Infrastructure)

- Testbed Architecture: network interface layer, interface standards, functional allocation standards
- Common Threat Models: seeker, airframe/autopilot, signatures, vulnerability
- Common Environment Models: tailored authoritative databases, runtime environment data services

“Virtual Test Ship”(specific to ship class)

- **Ship Characteristics**
 - Signature, motion, launcher placements, etc.
- **Combat System Representation**
 - Authoritative, “T&E quality” models of combat system elements

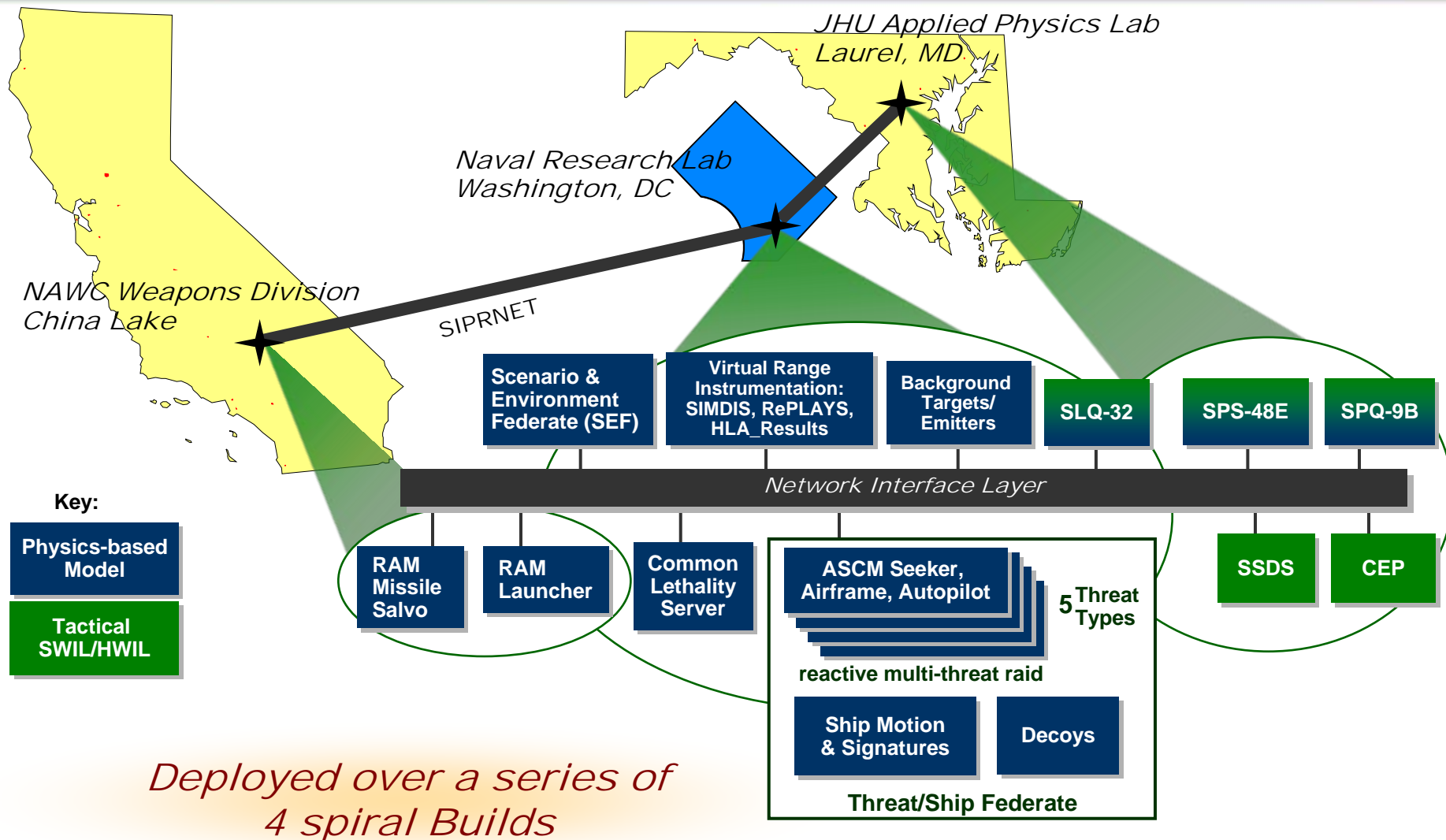


Current Simulation Framework Characteristics

- **HLA federation implementation**
 - All system representations execute simultaneously for each ship defense engagement
- **Geographically distributed**
- **Constructive simulation, conservative time management**
- **System representations are a mix of digital models and tactical software**
 - Most representations are a hybrid of tactical SWIL and digital model
 - Most tactical SW re-hosted to general purpose computers



P_{RA} Testbed Deployment LPD 17 Baseline





Enterprise P_{RA} Testbed Status

- **P_{RA} Testbed Configuration Working Group established under Ship Self Defense T&E Enterprise**
 - Testbed baseline IPTs established for current Enterprise ship classes: LHA 6, DDG 1000, CVN 21, and LCS
 - Enterprise Testbed Master Requirements initiated
- **LPD 17 Testbed Baseline nearing completion support of Ship Class OT&E**
 - CSSQT validation runs completed Dec 07; further V&V ongoing, leading to COTF accreditation
 - LPD 17 assessment planned for completion Dec 08



Enterprise P_{RA} Testbed Evolution

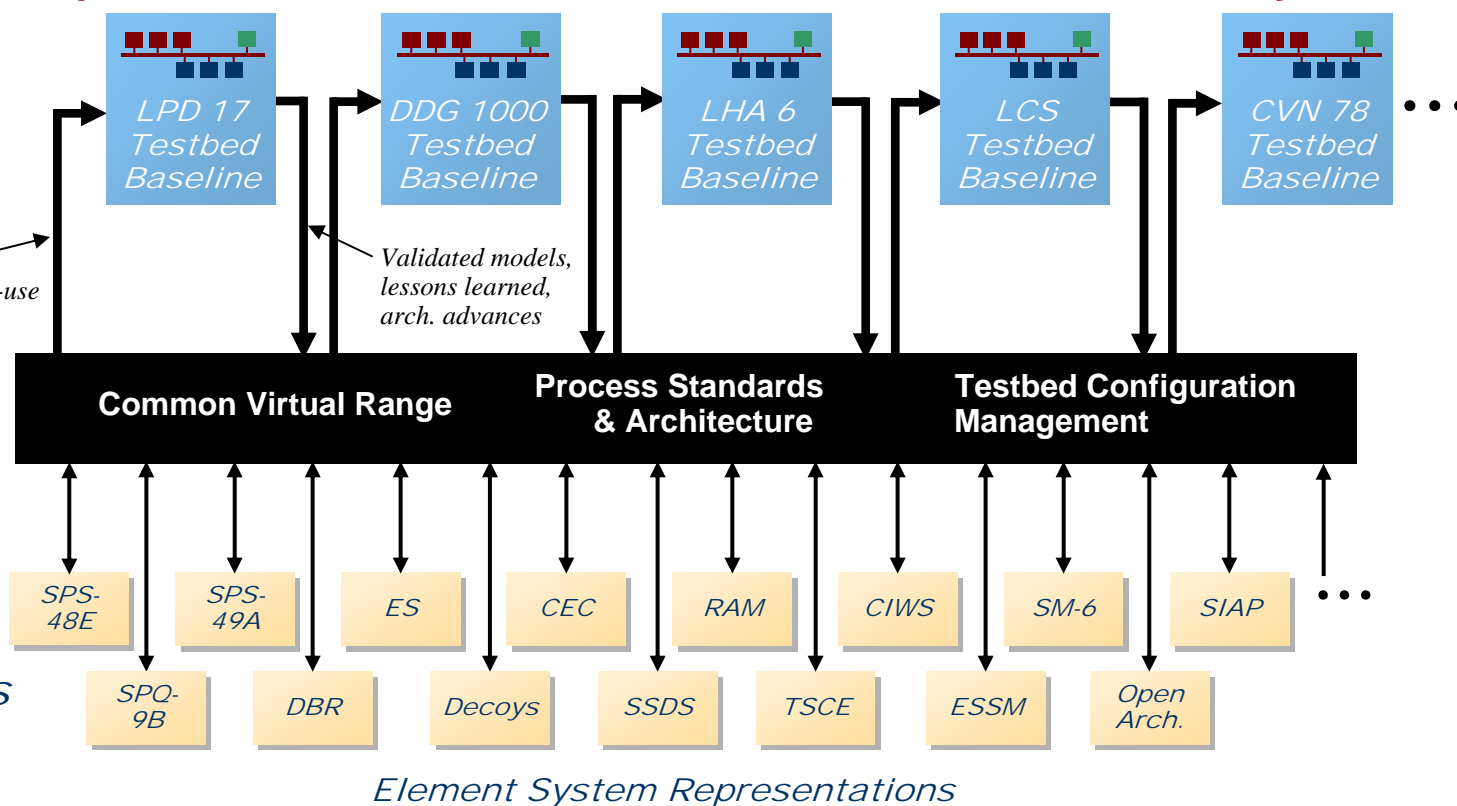
*Consistent Testbed development
across ship classes and CS configurations*

*Enterprise
 P_{RA} Testbed
Baselines*

*Common architecture,
common threats &
environment, model re-use*

*PEO IWS 7D
Leadership*

*PEO IWS
Project Offices*



*Significant cost avoidance through
re-use of models, virtual range, & architecture*



Challenges Ahead

- **Feedback of knowledge and capabilities to early phase acquisition systems engineering**
- **Improved mechanisms for injecting data needs into planning of empirical tests**
- **Relationship of P_{RA} Testbed simulations to other M&S supporting system development and T&E**
- **M&S capabilities development to support Family-of-Systems development**



Questions?

